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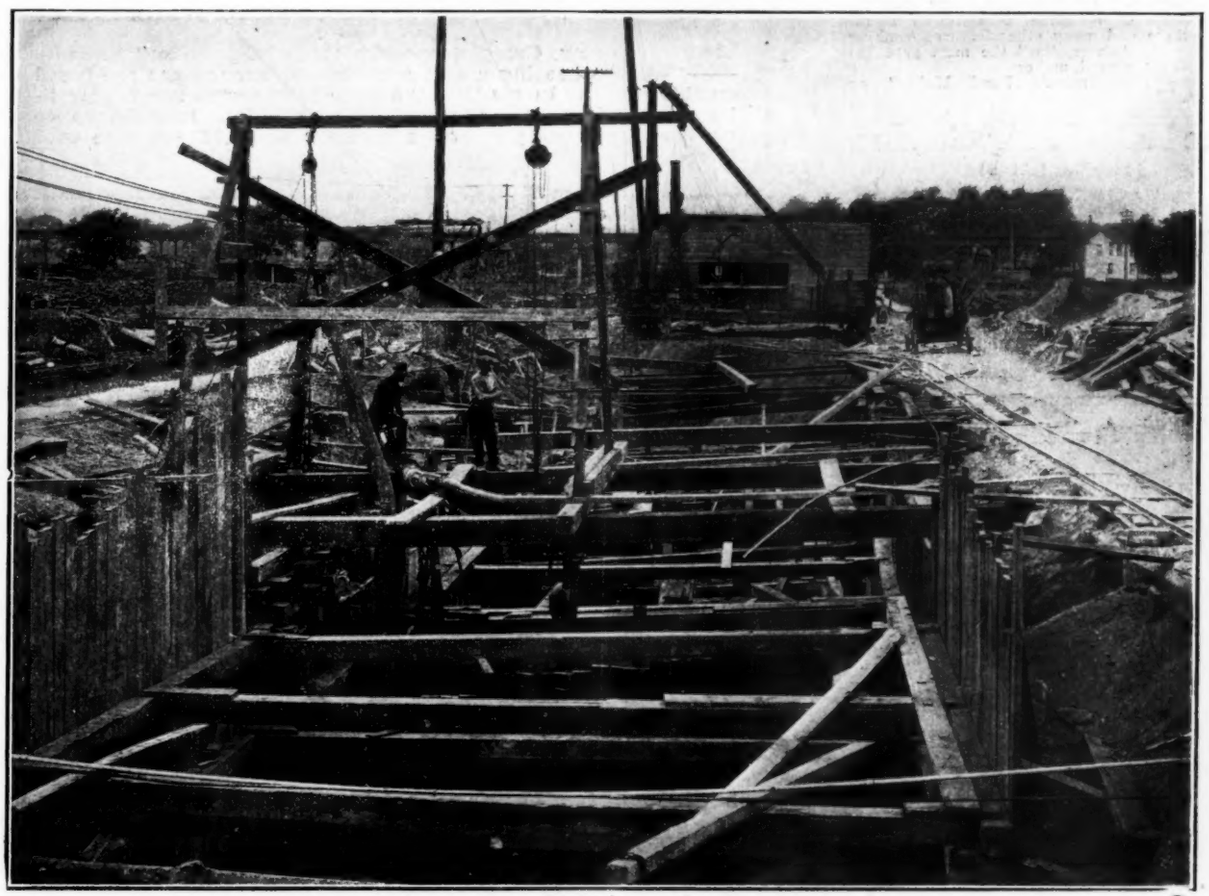

CONSTRUCTING THE AVENUE U SEWER

General view of the work at Tenth street; pump gantry in foreground, derrick and concrete mixer in background. See article in this issue.

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JANUARY 22, 1921

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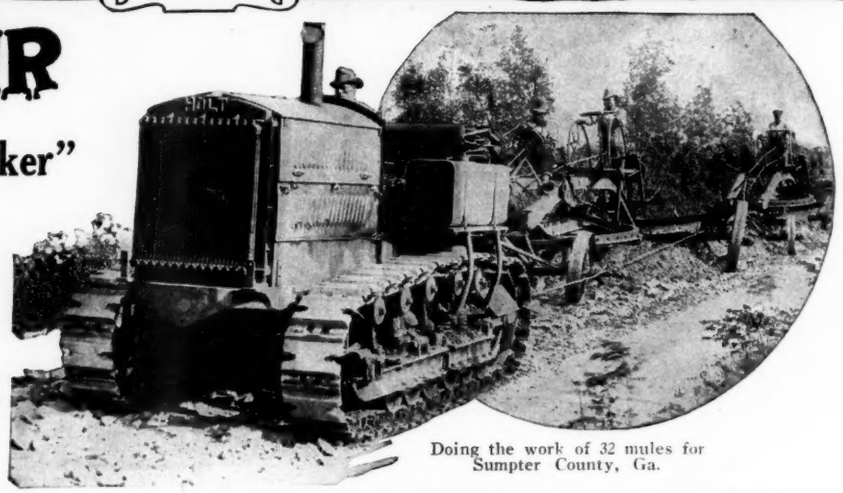

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Entered as Second-Class matter at the Post Office at Floral Park, N. Y., August 27, 1920, under the Act of March 3, 1879.

Vol. 50 **FLORAL PARK, JANUARY 22, 1921** **No. 4**

Electrically Driven Centrifugal Pumps at St. Paul

After operating the plant for more than two years, the Water Commissioners compare the cost of this with the steam-operated unit in service previous to that time, showing that for their conditions the latter cost 20 per cent more than the electrically driven pumps.

In 1917, the water commissioners of St. Paul, Minn., installed in the McCarron pumping station two electrically driven centrifugal pumps. A quite detailed account of the pumps and their operation is given in a report published by the commissioners in 1920. From that report is taken the matter contained in the following article.

This type of pump was selected because the cost of operating them, taking into consideration interest and depreciation upon the investment and the cost of electrical power, was less than the similar costs of any steam-driven pumping unit on the market at the time. The capacity guaranteed was that each unit would deliver not less than 5,000 gallons of water per minute against a total dynamic head of 171 feet and not more than 5,500 gallons against a total dynamic head of 158 feet.

The pumps were manufactured by the DeLaval Steam Turbine Co., of Trenton, N. J. They are single stage, double suction, single impeller type, designed to run at 1,200 revolutions per minute. They are operated by motors manufactured by the Electric Machinery Co., of Minneapolis, which are of the rotating field, synchronous type and each has a full load rating of 300 horse power when impressed with 3 phase, 60 cycle, alternating current at approximately 2,200 volts. Each motor has a 2.25 kw., 125 volt direct connected exciter for furnishing exciting current when running. They are designed to be started and brought to approximately synchronous speed as simple induction motors. When approximately synchronous speed has been reached, the auto transformers are cut out and full line voltage is impressed on the stator, the exciter is connected to the rotor windings and the motor falls into synchronism.

Each unit had a guaranteed minimum efficiency, wire to water, of 72 per cent when pumping continuously against any head between 158 and 171 feet and within the limits of the capacity of the pump. Shop tests indicated that both the pumps gave an efficiency of 80.5 per cent when delivering 5,500 gallons against a 150-foot head, and the motor gave an efficiency of 95.5 per cent on shop test at full load. When first constructed the exciter was only 1.75 kw. capacity, but in a performance test this was found too small and the 2.25 kw. exciter was substituted. After being placed in operation the efficiency of the two units steadily increased for three or four months and the average operating efficiency for the year 1918 was 79.5 per cent, which was higher than the efficiency obtained during the acceptance test.

Up to January 30, 1920, no repairs or replacements had been made to either pump. The rotor windings on one of the motors twice became loose and slightly damaged the stator windings so that they had to be rewound over a small area, but the damage was slight and the cost small. Toward the end of 1919 there was a slight falling off in efficiency and the top casing on one of the pumps was removed and the impeller examined, when the edges of the vanes were found to be a little frayed and the labyrinth rings somewhat worn. While the wear was very slight considering the length of time in operation, it was perhaps sufficient to affect the efficiency and it was proposed at the time of the report to substitute a new impeller for the old one.

The conclusion that this type of pump would be more economical than the steam pump has been borne out by the results. A steam plant with its boilers, condensers, feed-water heaters, boiler-feed pumps, super-heaters and other accessories is comparatively complicated and requires men of higher mechanical skill and intelligence than does the electric pump. The size of con-

taining buildings must be considered also and these can easily be compared on the cubic foot basis.

The charge for electrical energy is to a great extent governed by the ability of the city to shut down the pump during peak electrical loads at the plant of the company supplying the current, this being possible only when there are reservoirs for furnishing the water supply during such shutdowns; also upon whether or not the power company needs a balancing load and is therefore willing to grant special rates. The cost of electrical energy, coal and gas, as well as skilled labor vary so much in different localities that no attempt will be made to show what might be expected in other localities, but only what has been found in St. Paul.

The last year that a steam unit was used continously in the St. Paul plant was 1916, this unit being a 10-million-gallon Allis-Chalmers vertical, triple-expansion, crank and fly wheel type. During the year in question the average lift was 141.6 feet; the total amount of coal used, including that for changing boilers, but not that for heating the building, was 3,299,964 pounds, the amount of ash was 7.9 per cent; the duty per 100 pounds of coal was 106,303,700, Youghiogheny lump coal being bought on the B. t. u. basis at an average price of $4.40 per ton. This gave the fuel cost of raising one million gallons of water one foot as 1.73 cents.

The daily average pumping was a little over 8 million gallons and the pump therefore was not working at its full capacity and therefore probably not at its highest efficiency. However, in most plants the requirements do not equal the full capacity of the pump and, because of the difficulty of starting a large triple-expansion pumping engine, it is better to run them more slowly than to shut down and bank the fires. In other words, the difficulty of starting a triple-expansion pumping engine, and the consequent loss of efficiency in running it below its rated speed in order to co-ordinate the rate of running with the demand, is a point against this type of pump when compared with the ease of starting the centrifugal type of pump. It is possible that, if mechanical stokers had been used in this plant, a cheaper grade of fuel could have been burned, although in Minnesota freight charges represent a large part of the coal cost. The boiler performance records show an average actual evaporation of 7.76 pounds of water per pound of coal from a boiler feed water temperature of 120 degrees.

The power company contracted to furnish electrical energy to pump one million gallons of water against 158.5 feet dynamic head with an over-all efficiency of the combined pumping unit of 72 per cent at the rate of $4, the price to vary with the dynamic head and the efficiency, in direct proportion to the actual head and efficiency as determined in operation of the plant. As a matter of fact the average over-all efficiency of the electric pumping unit in 1918 was 79.5 per cent and the average head was 152.3 feet, and the cost was $3.48 per million gallons, or 2.28 cents per million gallons raised one foot. In 1919 the average over-all of efficiency was 78.5 per cent and the cost per million gallons raised one foot was 2.349 cents. Each of these costs is materially higher than the fuel cost of pumping with steam.

Averaged for a term of years, the cost of miscellaneous repairs, supplies, waste, oils, etc., for each million gallons raised one foot was 0.55 cent for the steam operated pump and 0.35 cent for the electrically driven pump. As to depreciation, the water commissioners believe that depreciation should not be charged in either case, since either type will give excellent service for 50 years; accessories, including boilers and impellers will have to be replaced every few years, but these and repairs should be charged to operation.

Labor is an important item. The steam plant requires men of higher intelligence and greater mechanical ability than the electric plant and also requires more men. It was estimated that at the present time the labor costs to raise one million gallons of water one foot would be 2.16 cents for the steam plant and 1.11 cents for the electric plant. "However, it is questionable if this holds good in practice for the reason that most cities hesitate to depend absolutely upon electricity for large installations. It is generally found that the men operating the electrical units are fully capable of operating the steam units and further that jobs are found for men who can qualify as firemen in order to have them available in case of necessity. When this is considered, the labor costs for the electrical unit approach those for the steam-operated unit."

Summing up the costs, the commissioners find that for the steam-operated pump the energy charge was 1.73 cents; miscellaneous supplies, repairs, etc., 0.55 cent, and labor 2.16 cents, or a total of 4.44 cents. For the electrically operated pump the energy charge was 2.28 cents; miscellaneous supplies, repairs, etc., 0.32 cent, and labor 1.11 cents, or a total of 3.69 cents. These figures show the steam operation to cost about 20 per cent more than electric.

Although depreciation was not included, there is to be considered the fact that the electrically driven unit costs less than a steam plant. Another question to be considered is whether or not conditions warrant placing absolute dependence upon electrical current, a question which must be decided for each individual case. "Very often when additional pumping capacity must be provided, the low first cost of the motor-driven centrifugal pump simplifies matters and solves what otherwise might be a difficult problem."

Financing Sacramento's Filtration Plant

The city of Sacramento, in financing its filtration plant which is expected to cost about $1,200,000, made arrangements with a San Francisco bank to take the bonds totaling $1,200,000, but to purchase them from time to time as the money is needed, thus saving the interest payments on a considerable amount of money lying

idle for months until the progressive steps of the construction should call for it. The plan contemplated the immediate purchase of $314,000 worth, holding this money for the payment of the construction work, and agreeing to take additional bonds at intervals as the sums in hand may be exhausted.

For State-Owned Cement Plants

Judge J. M. Lowe, president of the National Old Trails Association, urges the building of state-owned cement plants as one of the first steps to be taken by the Missouri legislature in the expenditure of the 60 million dollars of road bonds which have been voted. Cement must be used in the building of all high-class roads; and cement rock, which is the principal material used in the manufacture of cement, is available near the state penitentiary, and convict labor could be used in the state cement plants, the construction of which should be begun at once by the state, so as not to delay at all the building of roads. The cement alone, if purchased from private plants, would cost more than $11,000 a mile, a total cost of more than $17,600,000.

Avenue U Sewers, Brooklyn

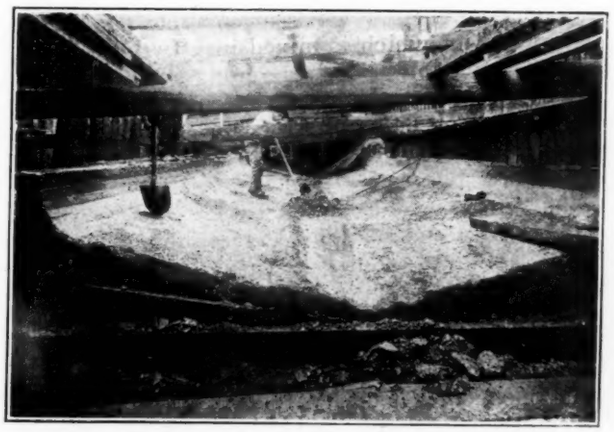
1,500 linear feet of 102-inch concrete storm water sewer built in open trench in wet ground and a 30-inch low-level pipe sewer constructed in advance. Heavy work progresses steadily with small force and limited amount of plant operating at a single point.

Extensions of the sewerage system in the southern part of the borough of Brooklyn, New York, include a section of 102-inch concrete sewer 1,500 feet long on the center line of Avenue U which makes connection with the 114-inch sewer on West 11th street and has a right-angle curved bend to connect with a future 102-inch extension on West 5th street and a 30-inch pipe sewer on West 11th street.

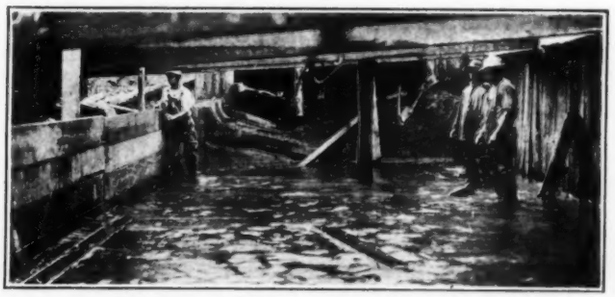
The storm sewer has a reinforced concrete flat slab roof 16 inches thick, a reinforced V-shape invert faced with selected bricks, and 17-inch vertical side walls without reinforcement. It is supported on a platform of planks laid on the tops of transverse bents of wooden piles. The external outline is rectangular with a width of 14 feet 7 inches and a height of 8 feet 8 inches with interior dimensions of 11 feet 9 inches in width and 6 feet in center height, with rounded corners. The upper surface of the center of the invert is from 3 feet to 1.58 feet below datum or mean high tide elevation, which is approximately ground water level.

Parallel to the storm water sewer, and at an invert elevation of from about 12 feet to 8.88 feet below datum, with its center line 3 feet 11 inches from the outer face of the storm water sewer, there is a 30-inch pipe house sewer enclosed in a rectangular mass of concrete with a minimum thickness of 6 inches, supported on foundation piles averaging two for every 4 linear feet of the sewer. The house sewer receives the flow from house connections through 8-inch stand pipes also enclosed in concrete and having tees receiving connections from both sides of the street, the 8-inch pipes that cross the street being supported directly on the roof of the storm water sewer.

The principal materials involved in construction are 1,478 linear feet of 30-inch vitrified sewer pipe, 348 linear feet of 6-inch house connection, 1,339 linear feet of 8-inch house connection, 488 feet of standpipes, 105,000 feet B. M. of foundation planking and pile caps, 20,000 linear feet of



CONCRETE INVERT READY FOR PAVING



WATER COLLECTED IN TRENCH WHILE PUMPS STOPPED FOR SHIFTING AHEAD, FINISHED INVERT AND ROOF FORMS IN BACKGROUND

wooden piles, 65,000 feet B. M. of sheeting, about 3,000 yards of concrete, 100,000 pounds of reinforcement steel and about 29,000 yards of excavation and 20,500 yards of backfill.

The work is designed and supervised by the Bureau of Sewers, Borough of Brooklyn, Arthur J. Griffin, chief engineer, and is being executed by Charles McDonald for a contract price of about $195,601.25.

EXCAVATION

A trench about 22 feet wide and from 13 to 23 feet deep is excavated in the center of the macadam street, where the old roadway surface is removed by hand and the sandy soil below is excavated by a ½-yard Blaw-Knox clam-shell bucket operated from the 40-foot boom of a stiff-leg derrick equipped with a two-drum Lidgerwood hoisting engine and traveling on a 25-foot gauge surface track concentric with the sewer. The derrick bucket delivers the excess soil to carts by which it is hauled about a ½ mile to the spoil banks. The remainder of the excavated material is delivered directly to a steel 3-yard sidedump car on a 30-inch industrial track laid alongside the trench to a point beyond the end of the finished sewer, on which spoil is dumped for backfill without rehandling. The distance between the excavating face and the face of the backfill is maintained at about 200 feet, which is limited by transverse bulkheads at both ends, shifted as the work advances.

PILE DRIVING

The trench is sheeted with two tiers of wooden sheet piles, the upper one having 2-inch units 8 or 10 inches wide and 16 feet long, and the lower tier having units 14 feet long. Two pile units 10 inches wide, or three units 8 inches wide, are driven at once by the 1,500-pound drop hammer operated by the derrick engine in leads suspended from the derrick boom. The piles are driven to a penetration about 4 feet below the bottom of the trench, the driving being assisted by a jet of water under city pressure. They are driven full depth at the rate of about 8 linear trench feet per day, and, after the completion of the sewer construction, are pulled by the derrick boom at the rate of about 16 linear trench feet per day, and redriven three or four times. The piles are braced by seven tiers of 8 x 8-inch transverse struts 10 feet apart on centers, engaging corresponding lines of 8 x 8-inch rangers.

After the excavation of the trench to sub-grade of the storm-water sewer, a third line of sheet piles is driven about 40 inches clear of the lower tier of sheeting and is braced to it and the sand between it and the outer sheeting is excavated down to subgrade for the sanitary sewer and the rangers and braces set as required.

Foundation piles 6 to 8 feet long are then driven in pairs 3 feet apart, capped and planked to support the house sewer pipe, which is laid on them bedded in a solid mass of concrete. The construction of this house sewer is always completed in advance of the storm-water sewer invert. It is the key to the difficult situation caused by the large amount of ground water and provides drainage for the excessive saturation of the sand up to a distance of about 8 feet below the surface of the ground.

PUMPING

At intervals of about 50 feet, 6 x 8-foot sumps are sheeted down 4 feet below sub-grade of the house sewer and are drained by one electrically operated 6-inch and one 8-inch Lawrence centrifugal pumps.

Over one of these sumps there is a timber gantry frame supported on the upper tier of the trench cross-braces. From it the pumps are suspended by tackles with which they are hoisted and sustained while the gantry is skidded ahead to another position as required.

For another sump there is provided a light gantry supported on beams spanning the trench. From this gantry tackles operated by a hand windlass or crab and differential chain hoists are suspended to handle the pumps. When another pump is required at either end of the open trench it is handled by the boom of the traveling derrick. Both of the pumps can be run continuously day and night without attendance, thus handling a large quantity of water in a very simple and satisfactory manner. If the water gets low, the 6-inch pump will suck and suck but will not require priming; the other pump requires priming if the water gets low but will start again automatically when the water rises 1 foot.

FOUNDATION PILES

The piles in the house sewer trench and those in the storm-water sewer trench are rapidly driven by the aid of a ½-inch jet of water under 50 or 60 pounds city pressure delivered through a 3-inch steam hose to the jet pipe, which quickly bores a hole in the sand and maintains it until the pile settles in it to approximate position and is hammered down to the exact elevation by an 8 x 8-inch wooden ram 10 feet long operated by hand. The piles in the transverse bents are capped with 8 x 8-inch timbers bored to receive the drift bolts. The piles are jetted down to approximate position in about three minutes when the ground is good.

CONCRETING

The construction of the storm-water sewer requires about 2 cubic yards of concrete per linear foot of sewer, which is mixed in a two-bag Ransome portable mixer moving along on the surface of the ground adjacent to the trench as the work progresses and delivering the concrete to a wooden chute through which it is spouted directly to position.

The invert is concreted between vertical wooden side forms in sections 32 feet long which are laid in about 3½ hours. Transverse wooden templates or ribs are set at the required elevation and securely nailed to the cross-braces of the trench timbering. To them are nailed three full-length panels of wooden lagging, two wide outside panels and one center panel with 8-inch openings between them, through which the concrete is placed for the center of invert, the remainder of the con-

crete being delivered through the openings at the bottoms of the side walls.

After the invert has been stripped and faced with brick or tile lining, a 32-foot section of upper forms is advanced on it and the walls and roof concreted in about 4½ hours. The upper forms have wooden lagging nailed to wooden frames carried on collapsible steel Blaw-Knox towers.

As the concreting is finished it is followed by a traveling rear derrick that corresponds to the excavating derrick in front and is operated by a two-drum Mundy hoisting engine. This derrick delivers stone and sand to the concrete mixer, pulls the sheet piles, removes the braces and handles backfill if necessary. The two derricks advance with an average space of about 300 feet between them.

During last summer the sewer was constructed at an average rate of about 5 feet per day by an average force of twenty men. Construction was commenced in September, 1919, and was about one-third completed December 1. It is expected that the work will be discontinued during severe winter weather and will be completed early next season.

Modern Cast Iron Pipe*

By A. F. Macallum, C. E. †

Advantages of De Lavaud centrifugal cast iron pipe demonstrated by tests made by Professor Gillespie, of Toronto University.

The present specifications for cast iron pipe are based on iron having a tensile strength of 20,000 pounds. When higher standards are given under the present foundry methods and mixtures the pipe is apt to be more brittle. On account, however, of new methods being adopted in the method of manufacturing iron pipe consideration is now being given to the revision of the specifications to meet these new conditions. This new method, developed by De Lavaud, a French engineer, is now being used in this country after being subjected to tests in comparison with the ordinary standard cast iron pipe by Professor Peter Gillespie of the Department of Applied Science, Toronto University. The process of manufacturing this new type of cast iron pipe involves the application of the principle of centrifugal force to molten metal at a high temperature (about 1,800 F.) in a permanent revolving mould. A regulated quantity of this cast iron is introduced into a revolving water cooled cylinder where, by the centrifugal force exerted, the molten metal is spread uniformly upon the surface of the mould. Within a minute the pipe is withdrawn from the mould at a white heat. The pipe is brittle after leaving the mould on account of the outer surface being chilled but after passing through an annealing furnace it becomes tough and much stronger than ordinary cast iron pipe, as shown by the tests made by Professor Gillespie. The pipe made under these conditions has a decided contrast in structure to pipe cast in sand moulds, where the casting is much slower and has not the segregation of impurities often found in the sand-cast pipe. As a consequence, the pipe is a homonegous, dense, fine-grained iron throughout, having no water or gas bubbles, and because of this density and strength the pipe can be made much thinner.

*Paper before Canadian Engineering Institute
†Commissioner of Works, Ottawa, Canada

In tests made by Professor Gillespie, a 6-inch pipe made by this machine was compared with a 6-inch Class C, ordinary sand-moulded pipe and out of the same iron, with the following results:

Centrifugal Cast Pipe	*Sand Cast Pipe*
Thickness, .28 inches	.51 inches
Tensile strength, 37,000 lbs. per sq. in.	16,000 lbs. per sq in.
Modulus of elasticity, 14,500,000	8,860,000
Modulus of rupture, 63,800	33,900
Quality factor, 20.2	9.8

From which it will be seen that the centrifugal pipe has a very high tensile cross-bending and resistance to shock values.

As found by these tests, the ratios of these to other co-efficients similarly found for the sand-mould pipe from the same iron are as two to one, or twice as strong.

In the tests for corrosion made by Professor Gillespie he found no difference, but in tests made at Sao Paulo, Brazil, it was found that the centrifugal cast pipe showed much better results than the sand moulded pipe.

In soils such as found in Ontario, it has been found that ordinary cast iron pipe has very little corrosion. The writer has removed a section of old English cast iron pipe laid in 1859 in Hamilton that showed no corrosion whatever, after being in the ground over 50 years, having even the weight marks clearly legible. This old English pipe was made much thinner than called for in the present day specifications and, being on a rising main, is still in service under more severe conditions from pressure than when laid.

These centrifugal cast iron pipe have a smooth exterior and interior surface, and besides reducing hydraulic frictional losses, take a much better surface coating.

It has been found that they machine easily and, because of the method of manufacture, the wall thickness is practically exactly uniform.

Because of its double strength, the centrifugal cast pipe can be made successfully considerably thinner than the sand-cast pipe, and as a consequence a twelve foot pipe 6 inches in diameter will weigh only 240 pounds compared with 430 pounds for a sand-cast pipe of the same diameter, with the consequent saving in freight rates on shipments of the same quantity of pipe.

This light weight of the centrifugal cast-iron pipe facilitates its laying, as a greater number can be caulked on the ground and lowered into the trench; besides, this latest development in the

manufacture of iron pipe brings it in competition with steel pipe under conditions that had practically limited the field to steel pipe and indicates an advance on previous methods.

Power for Public Utility Plants

The amount of power for public utility plants obtained from water and fuels during the first nine months of 1920, in each of the several states, has been determined and the figures tabulated by the United States Geological Survey. These figures are based on returns from about 3,000 power plants of 100 kw. capacity or more engaged in public service, including central stations, electric railways, and certain other plants that contribute to the public supply. Returns were received from plants the combined capacity of which was about 94 per cent of that of all plants listed.

The total output for the first nine months of 1919 was 28,341,000,000,000 kw. h., while for the same period in 1920 the output was 32,739,000,000,000, an increase of 15.5 per cent. The amount of fuels consumed during the nine months of 1920 totaled 27.7 million short tons of coal, 9.9 million barrels of fuel oil and 18.2 billion cubic feet of gas.

Taking the last month, September, we find that the total kw. h. produced by water power was 1,337,367,000, while by fuels the total was 2,269,997,000. In addition to oil and coal used as fuels, natural gas was used to the extent of 2,699,995 thousands of cubic feet, while wood was used for producing 13,597,272 kw. h. In Idaho, wood was the only fuel used, while the other states using wood were California, Florida, Louisiana, Minnesota, Mississippi, Oregon, Washington and Wisconsin. In Utah only 1,000 kw. h. was produced by fuels in September, but in all of the other states considerably larger quantities of fuel were used.

Some amount of electric power was produced by water power in all of the states except Delaware, Kentucky, Louisiana, Mississippi, North Dakota and the District of Columbia. The greatest amount produced by water power in any one state was 241,876,000 kw. h. in New York, which was closely followed by 224,801,000 in California; both of these figures being for the month of September.

Kansas City's Water Supply Improvement

Kansas City, Kan., has recently received a report from its consulting engineers, Fuller and McClintock, advising as to the extensions and changes necessary to adapt its water supply system to its present and future needs. The plans recommended involve an estimated expenditure of about $18,000,000, of which $1,600,000 is for additions to the distribution system. The plans include revetment and diking on the banks of the Missouri river to protect the site of the proposed plant, an intake founded on rock 80 feet below the river level, a pumping station, grit chambers and a filtration plant, a 7½-foot tunnel 4 miles long bringing the water from this plant to Kansas City, with about 5 miles of additional tunnel for distributing it through the city. The tunnels alone are estimated to cost 4½ million dollars.

A bond election will have to be held in order to raise funds for the work and it is hoped that the matter can be put in shape for submission to the voters in February. The urgent need of extensions to the present water supply system is generally recognized and it seems probable that the vote on the bond issue will be favorable.

Hose Burned by Water Friction

Titles similar to the above have appeared in several of the daily papers, the truth of the statement that the friction of water set the hose afire being vouched for on the authority of J. S. Caldwell, chief engineer of the New England Insurance Exchange. No such statement has been made by Mr. Caldwell, although it is true that the hose did catch fire, that friction caused it, and that water caused the friction.

The real conditions were that a single line of 2½-inch double-jacketed cotton rubber-lined hose, to which was attached a deluge set with a 1¾-inch outlet, was connected to a 750-gallon automobile pumping engine which was maintaining 250 pounds pressure on the discharge gage when the gate on the pump was so throttled that the opening was only ⅜ or ½ inch. The throttling of the discharge produced a stream of very high velocity which impinged against the side of the hose just beyond the coupling. Such was the force of the jet that it caused a slight deflection of the hose at the point of impact and excessive vibration or fluttering of the hose. This fluttering or extension and recession of the deflection caused a rubbing of the jackets together and in two or three minutes the hose at this point became perceptibly warm and in five minutes was so warm that the hand could not be retained against it, which was followed by the distinct odor of heated rubber and the appearance of smoke. This was followed soon by the discoloration of the outer jacket as the cotton was carbonized. The fibers then commenced to fray and part and, as the outer jacket let go, it was observed that the inner jacket was carbonized in the same manner. The total time required to cause the charring and bursting of the hose was approximately 15 minutes.

Following this occurrence, Mr. Caldwell experimented with a centrifugal and a piston fire pump and with two other well-known brands of hose, and from these tests concluded that neither type of pump nor brand of hose was a factor in the occurrence of such incidents; that the position of the gate in the connection must be that necessary to bring the jet caused by throttling it in impact against the hose at a short distance from the gate; that the cause is friction between the inner and outer jackets of the hose produced by vibration or fluttering of the hose at the point where the jet causes a deflection; and that the

conditions under which hose is burned or charred in this way would never be encountered in practical fire department work.

Durability of Metal Irrigation Flumes

Inspection of three miles on the Uncompahgre project indicates certain precautions to be observed in construction of such flumes.

A recent inspection of sixty-nine metal flumes having a total length of 15,735 feet for the Uncompahgre Projects, Colo., has been made during the last season and the results obtained are of interest as showing some of the considerations involved in design, and their durability in service. The circumferences of the flumes vary from 60 to 228 inches, only a small proportion of them being more than 168 inches. The oldest were installed in the fall of 1911 and the latest in the spring of 1920.

These flumes carry water for at least eight months in the year and during the remainder of the time they are alternately wet and dry, according to weather conditions, except as they sometimes fail to drain and continually retain water in the bottom.

The foundations were of concrete, stone, piles and timber bents, all of which were in satisfactory condition except that a few piles had rotted in alkaline soil. Where timber bents were used on adobe soil underlaid with shale, they generally settled from 2 to 12 inches. All piles and timber were creosoted.

All of the sub-structures were of wood, some of them untreated, some dipped in creosote, and some painted. The latter appeared to be in the best condition. The untreated work was weathered and considerably checked. In many instances where dirt and alkali, especially sand or sandy loam had come in contact with the posts and braces, they had decayed so much that it was necessary to cut them off and block underneath them and to replace braces in five or ten years. Treated timber lasts somewhat longer in sandy soil and gives excellent results in adobe soil.

Where considerable settlement was expected, wooden approaches to the flumes were built, and in many cases untreated 3-inch planks had rotted through. The remaining wooden approaches will be lined with concrete. Concrete and stone make the best approaches.

The flumes have been made of steel, of various brands and of No. 20 and 22 gauge, all of them galvanized excepting 250 feet of black metal used for a test.

PAINTING

Out of sixty-nine flumes, fifty-nine were protected by a coat of tar paint on the interior and that which has been applied within the last three years has proved superior to many other kinds of paint tested. The best results were obtained by applying the tar in warm weather to perfectly dry and clean surfaces with heavy brushes or burlap swabs. The joints should be tarred every fall and the entire flume every other fall. On one flume 502 feet long, 550 gallons of tar were used, providing an extra heavy coat, at a cost of 21 cents per square yard for labor and material.

The steel generally fails mostly at or near the joints, although pitting occasionally occurs in the invert. There is more pitting observed near black iron fittings than near galvanized iron fittings. Where the bottom of the flumes was badly pitted it was in several cases repaired by patching with cement bags covered with about 1 inch of concrete.

CONCLUSIONS

In the construction of flumes, careful attention should be paid to foundation and superstructure in order to maintain alignment and to keep superstructure from contact with earth.

Approaches should be warped in order to secure easy transition from canal section to flume section and back again.

The headwall of the approach of large flumes should be constructed to fit shape of flume when loaded.

Ample capacity and freeboard should be provided.

High velocities should be avoided if much heavy silt is carried.

In order to secure long life exceeding, say, 10 years under conditions as prevailing on the Uncompahgre project, the following requirements should be met:

(a) Proper design as to sufficiency of foundation, sizes of bands, washers and cross ties, and a thickness of metal which will obviate excessive deformation.

(b) Thorough galvanizing.

(c) Joints which do not project into the current and which avoid cavitation.

(d) Trapping out of sand and gravel.

(e) Coating with a good quality of coal tar of joints and of inside of sheets as frequently as wear makes necessary, possibly joints every year and inside surface every two, three, or four years.

(f) Provision for temperature changes either in the individual joints themselves or by expansion joints.

(g) Provision for self-drainage.

Philadelphia Begins Municipal Street Cleaning

After forty years of cleaning its streets by contract, during several of the more recent of which it was the only large city that continued this practice, Philadelphia has at last begun municipal street cleaning. Even yet, it is doing only about one-fourth of the work required for cleaning the entire city.

The entire city's area is divided into thirteen street cleaning districts, only two of which, districts 5 and 6, are under municipal operation. The work involved in these two, however, equals nearly one-fourth of the total amount of such work to be done in the city, as it includes the most frequented portion of the city, the retail business district. In this district, the ashes, rubbish and garbage are being collected also by municipal forces. In each of the other eleven districts the streets are being cleaned and the ashes and rubbish collected by a contractor who holds the contract for the year 1921, while the garbage also is being collected by another contractor.

There was much discussion last year as to the advisability of municipal cleaning of streets and collecting of refuse, while the officials themselves stated that it was impracticable to obtain by the first of the year sufficient apparatus and equipment of all kinds for performing such service for the entire city. The director of public works accordingly recommended that the two districts named should be taken care of by municipal operation in 1921 and this plan was adopted by ordinance of council approved November 17, 1920. The director's report gave no intimation of what policy would be adopted after 1921 and it is probable that definite formulation of such policy will be postponed until after several months at least of experience with municipal operation.

Commenting upon this, the Philadelphia Bureau of Municipal Research says: "Objection has been raised from influential quarters to the inauguration of municipal street cleaning because of unfriendliness to the policy of municipal ownership. As has been frequently pointed out, municipal street cleaning is not municipal ownership, but is a municipal service of the same general class as police and fire protection. It is of unmeasurable character and its performance is therefore not properly comparable with the operation of public utilities which furnish measured facilities or commodities."

Graphical Illustration of Municipal Expenditure

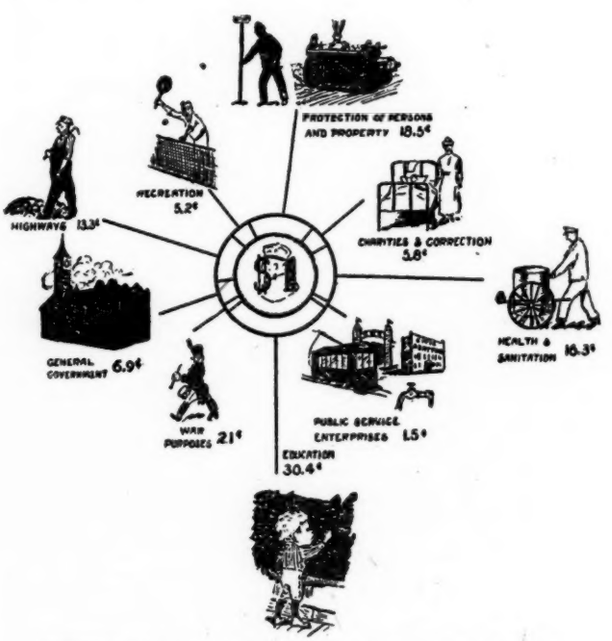
It has become more or less common for cities and other municipal corporations in this country to indicate for the taxpayers the relative amount of each dollar of municipal expenditure that goes for each of several classifications by a circle divided into sectors; but so far as has come to our notice, Toronto, Ont., is the first to supplement this by pictorial indications of the several purposes. From the 1920 issue of 'City Budget Facts," published by the Bureau of Municipal Research of that city, we reproduce such an illustration of the relative amounts paid out for the several public services.

This graphical presentation is supplemented by other diagrams showing expenditures under different classifications and also by tabulated statements classifying the revenues and expenditures. Attention is called to the fact that "departmental estimates are still unstandardized so that it is impossible to tell, from the city's budget, total proposed expenditures for each department and departmental function, analyzed according to budgets of expenditures or things bought, such as personal services, contractual services, heat, light and power, supplies other than heat, light and power, upkeep of structures and equipment." The bureau is convinced that the best administration requires standardized inter-departmental accounts, with standardized methods of estimating, and appropriate control based thereon.

The diagrams compare the gross expenditures analyzed by main functions, by organization units and by objects purchased for the years 1918, 1919 and 1920, respectively. Under the last-named classification the diagram shows that personal services had increased from about $8,000,000 in 1918 to $13,000,000 in 1920, all other expenditures in 1920 totaling $16,250,000, or a little more than the personal services alone, these including supplies, upkeep and depreciation, interest charges, sinking fund charges, etc.

Classified by organization units, it appears that expenditures by the board of education lead with a total of about $6,263,000, next in order being the works department with $5,339,000, the fire department being third with $2,073,000. These were the figures for 1920, which were about one-third greater than in 1918. In 1918 the war expenditure was something over $5,000,000, but this had dropped to less than $500,000 in 1920.

Analyzing expenditures by main functions, education leads with $6,816,000, with protection of persons and property second with a total of $4,250,000, public service enterprises totaled $3,882,000, and health and sanitation, $3,556,000; these all being the figures for 1920.



WHERE EACH DOLLAR OF TORONTO'S TAXES GOES

PUBLIC WORKS

Published Weekly
by
Municipal Journal and Engineer, Inc.
Publication Office, Floral Park, N. Y.
Advertising and Editorial Offices at 243 W. 39th St.,
New York, N. Y.

Subscription Rates

United States and Possessions, Mexico and Cuba....$3.00 per year
All other countries .....$4.00 per year

Change of Address

Subscribers are requested to notify us promptly of change of address, giving both old and new addresses.

Telephone (New York): Bryant 9591
Western office: Monadnock Block, Chicago

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FRANK W. SKINNER, Associate Editor

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Trenching in Wet Ground

The article in this issue describing the construc ing of a sewer in a wet, sandy soil in Brooklyn illustrates the advantage of draining such a soil in advance of the major part of the excavation. In this case a small sewer was laid six or eight feet deeper than a large one, at one side of the same trench, and sumps four feet deeper still were installed about every fifty feet. By keeping the sumps pumped down the trench was kept dry for the sewer laying and for most of the excavating.

The general idea is not new, and other methods of de-watering are in use, some of which we expect to describe next week. But by bearing it in mind and adapting it to varying conditions a contractor can often simplify a job and lower its cost. The writer once found excavation for a sewer to be entering a wet, mucky spot which he believed to be a pocket of small area in a clay stratum. By stopping construction temporarily and allowing the water to drain out through the sewer, he was able after a few days to continue the trench through a soil that was only damp and was the easiest of excavation.

In another case a quicksand that swallowed tools and workmen, when drained out, became so hard that blasting was found the cheapest way of loosening it; but bv so adjusting the drainage as to leave the sand damp it was excavated with ease while boiling of inflowing water was prevented.

Working in a clay trench where there is considerable water is expensive work. In such cases the water usually enters from the top of the clay stratum, which may be only a foot or two from the surface. By carrying a narrow drainage ditch a few feet back from each edge of the trench, sunk a few inches into the clay and kept a little ahead of the trench, most of the water can be intercepted by these two ditches and the trench kept fairly dry.

Most of these expedients cost money, but less than that lost by the miring of workmen's feet in clay, the extra handling of sand carried into the trench through or under the sheeting, the deposits of such sand in the conduits under construction, etc. In conditions of this kind a little brain work may save many dollars and perhaps lives.

Cost-Plus Contracts

The cost-plus contract is an excellent one in the proper place and when properly executed; in the wrong place or badly executed it may become very objectionable.

In the late war emergency it was necessary although generally as an admitted choice of evils. It there served its purpose and undoubtedly was a great advantage, far exceeding the disadvantages and abuses chargeable against it. Many of the best and most upright contractors executed their work under its provisions with the utmost fidelity, fairness and efficiency. Others faithfully endeavored to do the same but were unable to wholly eliminate the abuses to which this system is open. Still others deliberately took advantage of these opportunities for unfair and unjust practices and dishonest profits, but these were in a very small minority in the important federal construction operations.

With the reconstruction period and a return to normal conditions, the cost-plus form of contract will be less and less necessary and under ordinary conditions will justly be viewed with distrust. It is true that it is ideal on the basis of 100 per cent ability, efficiency and scrupulous integrity, economy and disinterestedness of all concerned, but when these are all assured the millenium will have been far spent, and there will be little need for contracts or legal obligations. At present average human nature is too weak to withstand a universal opportunity for authorized advantages at the expense of the other party.

Cost-plus contracts do not lend themselves readily to full competition, are very complex and indefinite in their responsibility, and invite ex-

travagances without offering any inducement for economy or efficiency.

Most high-class contractors and all private owners or corporations prefer free competition and lump sum, unit price, or sliding scale compensation contracts, and the contractor is entitled to profit by his ingenuities and economies rather than by his extravagances.

Fighting Construction Conspiracies

The fight against corruption, conspiracy and profiteering that has hamstrung construction and vital improvements that are sorely needed in this country, should be pushed to the utmost without regard to political considerations. If this is done, the evils, long known and suspected, will be disclosed and can be eliminated. If they are properly dealt with the improvement, now under way, of conditions in the construction field will be greatly accelerated and delayed operations will go forward so rapidly and continuously that a long era of high prosperity will result.

It all depends on the sincerity of the wish to cure these evils and the vigor and thoroughness with which the investigation is continued and adequate legal action is taken in accordance with its results.

The Lockwood Committee, the district attorney, the honest dealers, contractors, labor unions and the general public should support the investigation heartily and demand its fullest and most rigid operation, shielding no one and adequately punishing all that are found guilty.

We hope and urge that this may be the case, even if influential and hitherto respected parties are found guilty and suffer.

At this stage of the proceedings it is difficult to tell whether some of the irregularities may have been justifiable expedients to fight conspiracies already formed, but in no case can they excuse unjust or dishonest practices, gross profiteering, intimidation and violence that have been uncovered. The production and distribution of important universal staples is a public matter that does not permit of discrimination against individuals or localities and should be considered as are public utilities. The imposition of trivial fines and dismissal with mild reproof will be no deterrent for the future, and even if it checks the present offenders, new men and new methods will speedily resume the old practices if they are not severely punished and made impossible in the future. Jail sentences, if authorized by the law, maximum fines, the dissolution of illegal combinations and the most public exposure and censure of offenders are needed.

The honest and loyal citizens that form a large proportion of the labor unions undoubtedly wish their organizations to be clean and honest and should insist on the most searching investigation of their leaders, representatives, and agents and the deposition and severe punishment of all that are guilty of unfair practices, of collusion or even toleration of the methods of Brindell and others of his kidney.

The unions which, properly conducted, may be desirable organizations, can by no means afford to endorse or participate in any manner in these crimes. Neither should they tolerate for a moment any disposition to condone or ignore them, much less to conceal or defend them as some radicals do.

Obstacles to Construction Operation

Editor, Public Works,
243 W. 39th Street,
New York City.
Dear Sir:

I have read the letter from Mr. Connors and the editorial concerning it and wish to commence by congratulating Public Works on taking up this matter, which is one that cries aloud for reform.

I am in essential agreement with Mr. Connors, but would like to further emphasize the desirability, from the viewpoint of both the owners and contractors, of the cost plus a fixed fee basis, modified with a profit and loss sharing arrangement by which the contractor shares both expense and savings on either side of an accepted cost estimate.

There are many pieces of work on which, owing to various causes, it is impossible to give a close price that is fair to the owner and yet takes into consideration the risks run by the contractor. Such contracts are well covered by the cost plus a sliding fee, since competition is by no means eliminated by this method.

If each bidder submits his estimated cost and states the basis on which he is willing to share the losses, as well as to participate in the profits due to his estimate being under or over the actual amount required, then competition can be made and the work awarded on a competitive basis.

It is impossible, at the present time, for either employers or employed to be prosperous in the contracting business, and for this I think the chief blame can be laid at the door of labor, both organized and unorganized. I speak as a friend of organized labor, since I have always maintained that well-conducted unions are helpful to the success of a contractor, giving him a sufficiency of properly trained and qualified men. It is hard, however, for any employer of labor to feel any sympathy with the demands that have been made on its behalf during the last few years, and still harder to find any excuse for the undoubtedly reduced efficiency shown.

A thorough investigation is necessary. That the interest of the public should be aroused is also necessary and in arousing such interest, the press is the greatest power for good of any agency existing.

In bringing this matter into your columns I therefore feel that you are doing a service to employers of labor and to labor itself, and in consequence, to the country at large.

If labor can once be educated to understand and appreciate that its well-being is absolutely bound up in the prosperity of the employers, the end of hard times will be well in sight.

I believe that the majority of employers of labor realize that the well-being of labor itself is absolutely necessary to the success and prosperity of their own undertakings.

Very truly yours,
MacArthur Concrete Pile & Foundation Co.,
By D. McG. Newton,
Vice-President and General Manager.

Editor, Public Works,
243 W. 39th Street,
New York City.
Dear Sir:

Your editorial statement in the issue of January 15, "that the investigation (of the Lockwood Senate Committee) should be most thorough and impartial and all misdoings should be exposed and punished and measures taken to prevent their recurrence" is in complete accord with my sentiments and I want to take this opportunity of commending you for your excellent editorial on the situation.

Very truly yours,
C. A. Crane,
Secretary of the General Contractors' Association.

Construction in 1920 and in 1921

The F. W. Dodge Company's review of building activity says, in part: "The amount of money involved in construction contracts during 1920 in the twenty-five northeastern states of the country was practically the same as in 1919. On account of greatly increased construction costs, this amount of money, something over two and a half billion dollars, paid for a volume of construction that was nearly one-fourth less in 1920 than in 1919.

"The year 1920 opened with a rate of construction activity unprecedented for the winter season. Total contracts reached a maximum of over three hundred million dollars in the month of April. From that time on, for causes well known generally, activity declined more or less steadily to the end of the year. December contracts amounted to one hundred million dollars.

"In normal years the total estimated cost of contemplated or projected work reported is about 50 per cent in excess of the total amount of contracts awarded. In 1919 the total of projected work was 68 per cent in excess of contracts awarded; in 1920 it was 92 per cent in excess of contracts awarded. These figures give an indication of the amount by which each of the two years has run behind its announced construction program.

"In an analysis of the present price situation, a well-known authority has stated that the upward turn in material prices will probably occur some time in 1921 and that, in consequence, building costs in 1921 will be somewhat lower than they have been in 1920 or will be in 1922 and 1923.

"A volume of construction equal to that of 1919 on a cost basis somewhere near the 1919 level may be given as the most reasonable forecast for 1921. In money this would involve about two and a half billion dollars for the twenty-five northeastern states of the country, the same as the figure for 1920, though on a cost level that should represent a volume approximately one-third greater than the 1920 volume of construction.

"In 1921, residential construction and the construction of public works and utilities may be expected to predominate over other classes of buildings."

A Big Construction Company's Encouraging Opinion

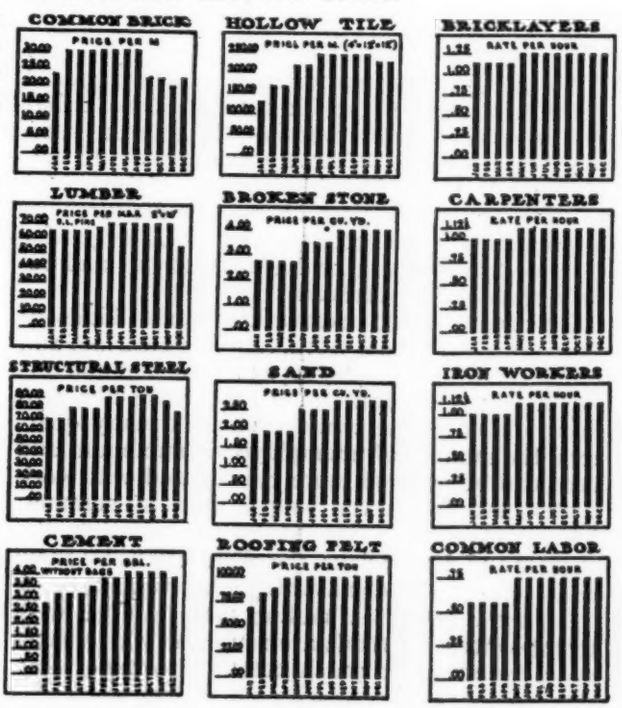
The George A. Fuller Industrial Engineering Corporation, in a review of building conditions in New York City, finds an increase during 1920 in the prices of all the principal construction materials, and of wages for mechanics. During the last part of the year, some material prices have dropped, but none except that of lumber have reached the 1919 level, and there has been little drop in the prices of cement and hollow tile and none at all in the exorbitant prices for sand and broken stone, raw materials that involve little more necessary cost than that of quarrying, crushing or screening and transporting. In wages there has been no reduction whatever in union rates.

"We look for a stabilization of material prices at lower levels in the late spring and early summer, when building activity will be revived under the encouragement of these lower prices. Some upward trend, even, may result from this increased building program, but 1920 peak prices will certainly not be seen again.

"The beginning of 1920 found wages in the building trades also high, and on May 1 there was a wage increase in practically every trade. Those not raised on May 1 were advanced on October 1, so that wages in all building trades are higher today than a year ago. In the face of a marked and continuing decline in living costs and a reduction in wages in many other lines of industry, the present wage scale cannot be justified much longer. A softening of the scale is already evident in unorganized and common labor circles. Union labor, however, operates under term agreements which fix the wage scale for definite periods. It will resist any wage decrease to the last, but it must unquestionably adjust itself to the new conditions.

"Contractors, like manufacturers, are rejoicing in the decrease in labor unit costs, due to the marked increase in the efficiency of labor, even though the wage scale is not changed. Whether this increased efficiency will be sufficient to keep wages at their present levels, however, is doubtful.

"The Lockwood Committee investigation has had a very healthy influence on the building business. Temporarily it has tended to check construction, and certainly has revealed some ugly conditions, but this much-needed surgical operation will leave the business as a whole cleaner and healthier than ever before."



MONTHLY PRICES OF BUILDING MATERIALS AND OF LABOR IN 1920.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems different will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one

What Disposition is Best for Construction Equipment During the Winter?

Winter work should be provided for permanent force, all plant and supplies inspected, appraised, scrapped or repaired and stored. New units made and schedules, bills and plans prepared for new and unfinished work.

In localities where the winters are cold and stormy, general contractors usually find construction operations very much limited or suspended for several months and should make provision in advance for the proper care of their plant and equipment when out of service, and to utilize the opportunity for doing special work that is likely to be neglected during the busy season as well as to make preparations for the future and perfect plans to reduce the cost and to expedite or improve new and unfinished work.

SPECIAL NEW WORK

An energetic contractor may often by special effort secure a considerable amount of work that can be done in the winter as well as in the summer and by careful planning can arrange to employ on it a considerable portion of his plant and equipment and part, at least, of his force, so as to maintain the better portion of his organization, secure a return on his investment, and reduce the cost of overhead.

Quarrying rock, excavation, some kinds of grading, most tunnel work, logging, clearing, and any kind of shop work, repairing or manufacturing that can be done under cover are likely to be available in the winter when, in many quarters, the number of unemployed is maximum and men can be secured more readily and will work better and for lower wages than in summer. These advantages are likely to outweigh the shorter and darker days, the obstructions by snow and ice, and the disadvantages of extreme cold.

In snow countries hauling may be done with teams where the roads are rough or where there are none at all, to much better advantage when the ground is covered with snow than when it is not, rivers and lakes may be crossed on ice where ferriage is difficult in summer, and very smooth, level tracks may be laid out on the ice to temporarily replace crooked, hilly, rough highways. When the ground is frozen hard it may also be possible to get access to and perform certain operations in swampy places that are difficult to negotiate in the summer. For heavy manual operations cold may not be objectionable if it necessitates constant activity to keep the men warm.

If the contractor can easily secure shed room or any suitable empty building he may often be able to make drain pipes, curbs, ornamental or dimension trimmings, or other articles of concrete that require careful finish in comparatively small forms or are made in great quantities that might otherwise be made on the work. He may also pre-cast in advance beams, girders, floor and roof slabs, etc., on the unit construction plan instead of casting them integral, in situ, thus saving much time.

In very cold weather it is found that some items of mechanical plant subject to heavy duty, especially steam shovels, are much more likely to injury and breakage than during moderate or warm months, so that many experienced contractors prefer to lay their steam shovels up entirely during January and February rather than do a small amount of work and sustain considerable damage.

CARE OF PLANT

All mechanical equipment should be housed either on the job or at the contractor's yard or shop, and if this is impossible it should be thoroughly secured and protected from storm, flood, theft, mischief or any kind of disturbance, detachable portions removed, and the remainder covered with canvas or equivalent. All portions likely to rust should be thoroughly oiled or greased.

Plant operated by steam, compressed air, or electricity, such as locomotives, hoisting engines, air compressors, pumps, rock drills, concrete mixers, and the like, should be thoroughly inspected, their bearings cleaned, oiled and adjusted, cylinders examined and packed, valves ground and set, and the machines tested, oiled and adjusted ready for immediate use when called for. Boilers should be emptied and thoroughly cleaned, the scale removed, the tubes examined, new grates furnished if necessary, safety valves overhauled, connections examined and the boilers tested by pressure in excess of their working load. Careful lists

should be made of broken or defective parts and these as well as any extras required should be ordered promptly to avoid delay later on. If the machinery is very badly worn it may be better to scrap it before attempting to repair it, merely saving more valuable parts, such as valves, gauges and the uninjured parts for repairs and extras for other plant. If no farther use is anticipated for it, it should be overhauled with a view to selling it at the first satisfactory opportunity. Special care should be taken to have it look neat and be well painted, attractive in appearance, easily accessible and in good running order for demonstration, and it should be advertised for sale and immediate delivery.

All derricks should be taken down and dismantled, the rigging very carefully overhauled, inspected and tested and all necessary repairs and renewals made. Steel derricks should be carefully inspected for bent places, injured plates, lattice bars or rivets, and should be thoroughly painted. Wooden derricks should be very carefully examined for cracks and decay, especially around the fittings, but should not be painted. The blocks, sheaves, spiders, links, clevises, hooks and bearings should be carefully examined and well greased or lubricated, the steel or manila cables should be unrove and every portion very carefully inspected for broken or frayed strands, and all serious defects should be cut out. Cables should be tied up in coils and marked with the size and length of rope and the derrick to which it belongs. Steel cables should be well covered with a preservative coating. Guy ropes should be carefully separated from hoisting ropes and much-used or old ropes from new.

Wheelbarrows, dump cars, skips, wooden buckets, wagon boxes, car trucks, running gears, batch boxes, and the like, should be overhauled and repaired and in many cases new ones can be advantageously made, using some of the old parts and trimmings, if good enough, to provide for the regular or increased quantity next season.

All hand tools should be assorted, put in order, and stored on shelves, in bins, or in portable boxes ready to be sent out on the job. Where there is much plant involved, a good machinist with a few simple standard machine tools operated by steam or electricity, a blacksmith, and a carpenter, with sufficient helpers, can be very profitably employed putting all of the equipment in first-class order and saving much that otherwise would be lost or destroyed.

A simple Telfer system with a differential chain hoist mounted on a trolley, traveling on a convenient overhead track made of angles, I-beams, channels, or even of wooden joists, can be installed at little expense and save much time and labor in handling heavy pieces in the storage and shop. The storage house should be provided with bins, shelves and hooks for keeping all supplies, equipment, and extra parts, and an accurate description and inventory, with prices or values, should be kept and depreciation posted, as articles are brought in or out and credited or charged.

Employment can be found for some of the office force in making estimates, bills of materials for new and unfinished work and in preparing the orders in advance so that they are ready to issue as soon as it is expedient to make the purchases. Drawings, sketches and complete working plans and descriptions of methods for improved operations can be studied and prepared, and details worked out for home-made contrivances and equipment. Any work of this nature that can be done in advance and unhurriedly in the comfortable, convenient office will be found to be much cheaper and more satisfactory than if done in an emergency or under difficulties on the job, since mistakes and experiments are far cheaper on paper than in the field.

Wherever it is possible, the methods and operations should be studied in advance and a complete schedule prepared showing just when each operation should be begun and ended, how many men are required, what plant, tools, machinery, materials and supplies are necessary, when and where they should be delivered and in what quantities. This can be combined with or added to a progress sheet posting the state of the work by very simple checking or marking with colored pencils daily so as to show essentials instantly by inspection and will be found very useful and satisfactory for any job that requires different kinds of work and material. It will directly save time and money and will encourage and stimulate the men and materially assist the superintendent.

Labor Notes

Increased efficiency of sawmill and woods labor in all sections of the south is reported by the Southern Pine Association. Notwithstanding reductions which have been made in the number of men employed by the companies, an increase in the output is shown. The number of colored men seeking work is much larger than heretofore, this being attributed to the fact that the negro is gradually realizing that he does not fit into northern industries and is returning to his old clime.

The increasing number of reports of mill and factory shut-downs and part-time work, together with the announcement of reduction in wages made by many large employers, notably the Bethlehem Steel Company, textile works, garment makers, many rubber companies, the Pullman Company, and other concerns together employing hundreds of thousands of men that have reduced prices up to 25 per cent, is bound to have a wide-spread effect and in some places the employees recognize the signs of the times and have consented and even offered to accept the reduction cheerfully rather than be thrown out of employment. Even the bricklayers' union of Springfield, Mass., consents to starve along on the present rate of $1.05 per hour until next April, when their demands for $1.50 per hour will be renewed.

Recent Legal Decisions

OFFICERS ELECTED UNDER UNCONSTITUTIONAL CHARTER PROVISIONS ARE DE FACTO OFFICERS

The Michigan Supreme Court, in a proceeding to test the validity of the voting system for electing members of the governing body of the city of Kalamazoo under a recently adopted charter, Wattles v. Upjohn, 179 N. W. 335, holds that all city officers legally nominated and formally found elected under color of the voting system provided in the charter, who qualified and acted as such, were and are de facto officers whose official actions within the scope of the charter are valid until they are formally deposed from such positions.

ASSESSMENT NOT INVALIDATED BY OMITTING RAILROAD NOT BENEFITED

The California Supreme Court holds, Bailey v. City of Hermosa Beach, 192 Pac. 712, that an arrangement between a city and a railroad company that a street improvement should be without expense to the company does not invalidate the assessment of other lands where it does not have the effect of throwing onto them a portion of the expense which they should not bear, and also where the company's lands were not benefited. Of course, if the railway company's lands would be benefited by the improvement so that a portion of its expense should be assessed against them, then the arrangement would have to be carried out in some other manner than by failing to assess those lands.

PRINCIPLES OF ASSESSMENTS FOR IMPROVEMENTS

Many decisions by courts of last resort, including the Supreme Court of the United States, establish the following principles respecting taxation for improvements: It is competent for the Legislature, under the taxing power, to determine the area of property benefited by the improvements for the purpose of establishing a tax district unless, as said in Branson v. Bush, 251 U. S. 182, it is "arbitrary" and "wholly unwarranted"—"a flagrant abuse, and by reason of its arbitrary character a confiscation of particular property." The property owners within the area of assessment are not entitled to be heard upon the question of the creation and limitation of the district, but they are entitled to be heard upon the apportionment of taxes within such district. It is competent for the Legislature to create a tax district for the purpose of raising money to pay for improvements already made, and likewise to substitute the tax district for another. The Legislature may also determine the basis of assessment, whether it shall be on area, on value, on location with reference to the improvement, or on any other reasonable basis that the Legislature, in the exercise of its discretion, deems to be just and equitable. Valley Farms Co. v. City of Yonkers, 184 N. Y. Supp. 300.

COMPELLING REMOVAL OF CAR TRACKS TO CENTER OF STREET—PAVING BETWEEN TRACKS

The North Carolina Supreme Court holds, City of Raleigh v. Carolina Power & Light Co., 104 S. E. 462, that where the boundaries of a city are extended to include a highway along one side of which street railway tracks run, the city may, both under a provision in the franchise to the company that the tracks shall be located wherever practicable in the center of all streets, etc., and under the city's general police power over the streets, require the tracks to be removed to the center of the street, the safety of the citizens requiring that street car tracks shall be in the center of the street in cities and towns. Under an express provision of a franchise that the company shall pave the space between the tracks when the city shall pave the streets, a city can compel a street railway company to pave the space between the tracks after such extension of the city boundaries. This also would be a proper exercise of the police power, as it is as necessary for the safe and convenient use of the street to pave the space between the double track as to pave the space between each individual track.

STATUS OF MUNICIPAL BOARD OF WATER WORKS AND LIGHT

The Georgia Supreme Court holds, Dobbs v. Brumby, 104 S. E. 440, that under the Georgia statute of 1906, creating a board of lights and waterworks in the city of Mariette, and making it a body corporate with powers incidental to the discharge of its duties, with the right to sue and be sued and giving it charge of the water supply for the city, with the power to contract therefor, and for light, to regulate the rates, to contract with other companies, and to handle proceeds of bonds, the board was a subsidiary or auxiliary commission of the city. When the board contracted to purchase a competing company's franchise, good will, contracts with its customers, and certain physical property, and to pay the price in installments through a series of years, and from money illegally borrowed, it created a prohibited debt within the Georgia Constitution.

CITY HELD NOT LIABLE TO CONTRACTOR FOR INTEREST ON BANK DEPOSIT

In a contract for construction work between a city and a contractor there was no provision requiring the city to keep separately money coming to the contractor. The Massachusetts Supreme Judicial Court therefore holds, Goldman v. City of Worcester, 128 N. E. 410, that the title to its bank deposit remained in the city, which sustained no fiduciary relation to the contractor; and the latter could not claim the proportionate part of interest on the city's deposit which accrued while moneys due him were held up pending the determination of lien claims.

NEWS OF THE SOCIETIES

Jan. 25—NEW JERSEY STATE ASSOCIATION OF COUNTY ENGINEERS. Annual meeting. Engineers' Club, Trenton, N. J.

Jan. 25 — ATLANTA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with Atlanta Section, A.S.C.E. Carnegie Library.

Jan. 25 — PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Engineers Club of Philadelphia.

Jan. 25-27 — MICHIGAN ENGINEERING SOCIETY. STATE ASSEMBLY OF THE A.A.E., Detroit, Mich.

Jan. 25-27 — THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25, 26, 27—ASSOCIATED GENERAL CONTRACTORS. Annual meeting, New Orleans. Secretary's Office, Washington, D. C.

Jan. 27-28—INDIANA ENGINEERING SOCIETY. Annual meeting, Indianapolis. Secretary, Charles Brossman, Merchants Bank Building.

Jan. 28 — COLORADO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Metropole Hotel.

Jan. 31-Feb. 5—NATIONAL BRICK MANUFACTURERS' ASSOCIATION AND COMMON BRICK MANUFACTURERS' ASSOCIATION OF AMERICA. Joint meeting. Hotel Pennsylvania, New York City.

Feb. 1-2—NEW YORK STATE ASSOCIATION OF BUILDERS. Convention. Rochester, N. Y.

Feb. 1, 2, 3—ONTARIO PROFESSIONAL MEETING in conjunction with the annual meeting of the Engineering Institute of Canada. Toronto.

Feb. 1 — CLEVELAND SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Cleveland Engineering Society's rooms.

Feb. 8—BOSTON SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Feb. 7-8—FLORIDA ENGINEERING SOCIETY. Annual meeting. Lakewood, Fla.

Feb. 9-12 — AMERICAN ROAD BUILDERS' ASSOCIATION. Eighteenth annual convention, eleventh American Good Roads Congress and twelfth National Good Roads Show, Coliseum, Chicago, Ill.

Feb. 11-12 — ENGINEERING SOCIETY OF WISCONSIN. Annual meeting, Madison. Secretary, Leonard S. Smith, Madison, Wis.

Feb. 14-16 — NATIONAL CIVIC FEDERATION. 21st annual meeting. Hotel Astor, New York.

Feb. 14-16 — AMERICAN CONCRETE INSTITUTE. Annual meeting. Auditorium Hotel, Chicago, Ill. Secretary, Harvey Whipple, New Telegraph Building, Detroit, Mich.

Feb. 16-18 — AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Seventh midwinter convention. Engineering Societies' Building, New York City.

Feb. 28 — PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Engineers' Club of Philadelphia.

May 9-11—AMERICAN ASSOCIATION OF ENGINEERS. 7th annual convention. Buffalo.

May 17-19—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

June 7-9—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

June 6-10, 1921—AMERICAN WATER WORKS ASSOCIATION. Annual convention at Cleveland, Ohio. Secretary, J. M. Diven, 153 West 71st St., New York.

Oct., 1921—IOWA SECTION, AMERICAN WATER WORKS ASSOCIATION. Seventh annual meeting. Omaha, Neb.

THE NATIONAL CIVIC FEDERATION

The twenty-first annual meeting of the National Civic Federation, Judge Alton B. Parker, president, and Samuel Gompers, vice-president, will be held February 14, 15 and 16 at the Hotel Astor, New York.

Outstanding industrial problems, with which the American people are confronted to-day, from both the national and the international viewpoints, will be discussed and it will be endeavored to secure impartial consideration of existing facts, conditions and requirements involving the mutual or divergent interests of capital and labor, industry and finance.

The program for the federation's annual meeting will include, in addition to topics indicated by the problems presented in the foregoing, reports from its Workmen's Compensation Department, Social Insurance Department, and especially the new Department on Study of Revolutionary Movements. During the past year through fifteen sub-committees the last named department made an extensive study of the extent to which the revolutionary forces in this country have penetrated the various groups making up our citizenry: labor, agriculture, the church, the college, the public school, philanthropic agencies, negro and foreign groups, and women's organizations. This investigation has resulted in some amazing revelations which call for most serious consideration by those who believe that the institutions of our country should be safeguarded against the "boring from within" policies of the Socialists, I. W. W.'ites and Bolshevists.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The American Society of Mechanical Engineers has formed a Material Handling section. About 700 members of the society have been enrolled, although only a small part of the society's membership has been formally notified of this professional section.

The executive committee of the section, consisting of R. M. Gates, chairman; H. V. Coes, Kern Dodge, Nathan C. Johnson and F. A. Wardenberg, has issued a statement saying that great potential interest has been aroused in the bringing together of individuals who desire to help in solving the handling problems of mining, transporting, manufacturing and distributing of all materials.

The executive committee in its preliminary study of the proposed activities of this section is considering the advisability of organizing committees, as required by the amount of work in the province of each, along two entirely separate lines: 1. According to types of material handling equipment, such as conveyors, cableways, cranes and the like; 2. According to industries which have material handling problems, such as steel manufacturers, storage warehouses, commodity distribution centers, construction work, automobile or tire industries and the like.

It is the intent of the section to thoroughly discuss the controlling factors in each line by meetings held by these various committees so as to develop better methods of handling materials and to standardize equipment and methods where the same are desirable.

DENVER CONTRACTORS TO JOIN ASSOCIATED GENERAL CONTRACTORS

Denver contractors and engineers recently organized with a view to associating themselves with the A. G. C. of America. They will send representatives to the New Orleans meeting of the association on January 25-27.

IOWA ENGINEERING SOCIETY

The thirty-third annual meeting was held at the Chamberlain Hotel, Des Moines, Ia., January 18-20, 1921. The principal features besides routine business were as follows:

First session of the section on Drainage Engineering, "Design of Sizes of Tile Drains," D. L. Yarnell, Washington, D. C., senior drainage engineer, Bureau of Public Roads. "Determination of Maximum Run-offs from Stream Gaugings," E. D. Burchard, Ames, Water Resources Branch, U. S. Geological Survey, in charge of work in Iowa. "Some Special Problems in Open Ditch Design, with Particular Reference to Prevention of Silt Deposits," Q. C. Ayres, Ames, Agricultural Department, Iowa State College.

Second session of the section on Drainage Engineering, "Hydraulic Fill Dams and Levees," S. M. Woodward, Iowa City, professor of Mechanics and Hydraulics, University of Iowa. "Quality Requirements in Drain Tile Specifications—Concrete Tile," R. W. Crum, Ames, Materials Engineer, Iowa State Highway Commission. "Quality Requirements in Drain Tile Specifications—Clay Tile," S. L. Galpin, Ames, Ceramics Department, Iowa State College. "The Location and Design of Surface Inlets in Tile Drains," C. E. Gross, Eagle Grove, Drainage Engineer.

Iowa Engineering Society—Address of Welcome, by K. C. Kastberg, Des Moines, president, Engineers' Club of Des Moines. President's Address, by H. H. Dean, Council Bluffs, county engineer, Pottawattamie county. "The Cost Factors of Engineering Practice," C. H. Young, Muscatine, president, Central States Engineering Company. "Cost Keeping on Construction Work," F. H. Austin, Webster City, secretary, Currie Engineering Company. "Contracting as a Profession," F. C. Young, Waterloo, Moore-Young Construction Company.

Third session of the section on Drainage Engineering — Experience meeting—topics: Clean-out Work; surveys, plans and specifications, construction equipment and methods, costs Drainage District Surveys and Maps—surveying methods, data shown on

map, completeness of detail. Bases and Methods of Estimating Costs—of tile, hauling, labor, and backfilling; of open ditches; of levees; of construction engineering services. Unusual Repair Work—nature? how made? how successful? Drainage Specifications—what should be required? how enforced? Experiences—for tile work; for open ditches; for levees. Drainage contract provisions—submission of bids; contractor's bonds, amount, actions and collections under; force account vs. cost plus work; payments; engineer's authority and responsibility. Office Methods and Forms for Drainage Engineers. Inspection and Tests of Drain Tile.

Section on Highway Engineering—"Primary and Secondary Road Assessments," F. W. Parrott, Ames, auditor, Iowa State Highway Commission. "General Discussion on Primary and Secondary Road Assessments—Some Recent Observations of Pavement Failures," T. R. Agg, Ames, professor of Highway Engineering, Iowa State College. Question Box and Round Table Discussion—topics: Dirt Road Construction and Maintenance. Building Roads with Available Materials. Cost of Permanent Highway Bridges. Road Design. The Iowa Road Construction Program in 1921.

Section on Municipal Engineering—"Pavements," M. L. Patzig, Des Moines, consulting engineer. "The City Manager Plan," O. E. Carr, Dubuque, City Manager of Dubuque. "Water Supply in Iowa," J. J. Hinman, Jr., Iowa City, Senior Bacteriologist and Chemist, State Board of Health. "Rates of Excessive Precipitation in Iowa," M. I. Evinger, Des Moines, civil and sanitary engineer.

Question Box and Round Table Discussion—topics—The Actual Life of City Pavements. Operation of Sewage Treatment Plants. Relation of Landscape Architects to Engineers. Standardized Building Codes and Ordinances for Iowa. Office Procedure and Management by the Engineer.

Fourth annual camp fire; informal discussion. Topics—Our District Clubs; The Engineering Barometer.

Inspection trip to points of interest in Des Moines. Annual rump convention. Informal banquet and dance at the New Savery Hotel.

ASSOCIATED GENERAL CONTRACTORS ASSOCIATION

The second national conference will be held at the Hotel Grunewald, New Orleans, La., on January 25, 26, 27, 1921.

January 25, papers will be presented by the leading architects and engineers of the country on the most vital subject before contractors, viz.: "Contracts, General Conditions and Specifications." In order that the various types of construction will be fully covered, the papers, and their subsequent discussion, will be carried on simultaneously in four groups so that building contractors, highway contractors, railroad contractors, public work contractors will have full opportunity to tell their troubles and help find solutions for them.

Wednesday morning, January 26, is set aside for a business session for the whole association. The report of the executive board will be made and plans for the future development of the A. G. C. will be presented for discussion. There will be a boat ride in the afternoon on the Mississippi river and moving pictures, beginning at 8 p. m., showing latest construction methods.

Thursday, January 27, the different groups of contractors will have an opportunity to listen to such important subjects as: Compensation Insurance; Relations with Sub-contractors; Why Highway Contractors Lose Money; Immigration, and Should Unlimited Competition Be Continued on Public Works. In the afternoon is the final general meeting to act on resolutions, elect a nominating committee and greet the newly elected officers.

The entertainment features of the program are the following: On Tuesday, January 25, at 8 p. m., a smoker, entertainment and refreshments—stag and a big time; also a theater party for ladies; on Wednesday, January 26, at 2 p. m., a boat ride on the Mississippi river for members, guests and their families; on Wednesday at 8 p. m., moving pictures showing latest methods in construction; and on Thursday, January 27, at 7 p. m., the annual dinner.

THE ENGINEERS' CLUB OF PHILADELPHIA

The subject for the regular meeting of Friday, January 7 was "The Development and Future of Handling Freight by Motor Trucks."

Mr. F. W. Fenn, secretary of the National Motor Truck Committee, of New York City, addressed the meeting on "Better Highways and Motor Transportation As an Aid to Production." Mr. M. O. Eldridge, Director of Roads, A. A. A. Good Roads Board, of Washington, D. C., submitted a paper in regard to a rather unique motor truck line established within the past year and operating very successfully between Washington and points in southern Maryland.

On December 21, the regular meeting of the Engineers' Club was held at 8:15 p. m. Minutes of the regular meeting held November 17 were approved. The tellers reported that 226 legal ballots had been received on the question of amending Article IV, Section 19; Art. VI, Sec. 7; Art. VII, Secs. 1 and 2; Art. VIII, Sec. 10; Art. IX, Secs. 2, 6 and 7; and Art. XIII, Sec. 2, of the By-Laws and that all these amendments as proposed had been approved.

On the subject of "Road Construction for Heavy Truck Traffic" a communication from Major J. M. Ritchie, Quartermaster Corps, U. S. Army, was read; Mr. Earl B. Smith, Senior Assistant Testing Engineer of the Bureau of Public Roads, Department of Agriculture, Washington, D. C., gave the results of recent tests and calculations of impact on roads by trucks with varying loads and speeds; Mr. Childs, representing Mr. John W. Mackall, Chief Engineer, Maryland State Roads Commission, read a paper on "Limiting Truck Traffic to the Size, Weight and Speed Which the Roads Can Withstand"; Mr. H. Merkell, Jr., secretary of the Motor Vehicle Conference Committee of New York, on a "Uniform Vehicle Law"; Mr. Prevost Hubbard, Chemical Engineer of the Asphalt Association, New York, on "Some Considerations Governing the Design of Pavements for Heavy Traffic"; Messrs. C. M. Pinckney, Chief Engineer of New York City, R. Keith Compton, Chief Engineer of Baltimore, W. G. Thompson and J. E. Morris, of New York, took part in the discussion. Above papers, with illustrations and discussions will be published in an early number of *The Journal*.

BROOKLYN ENGINEERS' CLUB

At the regular meeting of the Brooklyn Engineers' Club on January 13, 1921, a paper on "Electrification of Staten Island Railroads," presented by Randolph H. Nexsen, electrical engineer for the Public Service Commission, outlined Staten Island Transportation Conditions, Proposed Electrification of Rapid Transit System Serving Richmond Borough only and not connected with City Rapid Transit System; gave transportation facilities and statistics, and suggested self-contained rapid transit plan designed for ultimate connection with the city rapid transit system.

BROOKLYN ENGINEERS' CLUB

The paper announced for the meeting of Feb. 3 will be presented by T. Kennard Thompson on the "Canalization of the St. Lawrence River and Development of Water Power of the St. Lawrence and Niagara Rivers." Lantern slides will be used and as there is much of general interest in this project, ladies are invited to be present at the club house, 117 Remsen street, near Borough Hall at 8:30 p. m.

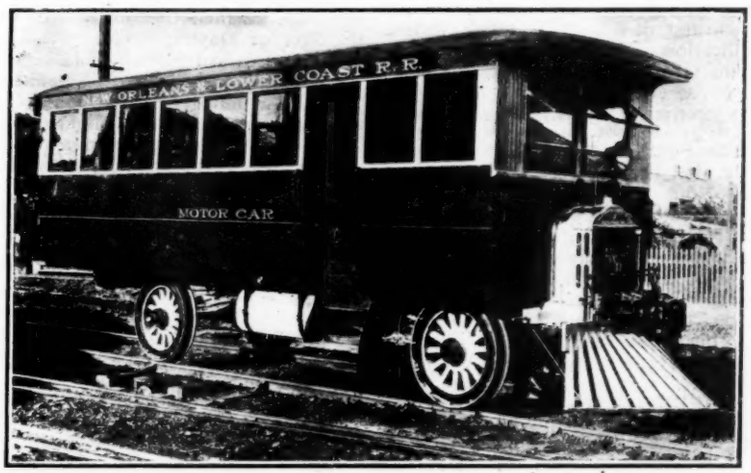
NATIONAL CONGRESS OF BUILDING AND CONSTRUCTION INDUSTRY

Plans are now being perfected for convening the first session of the National Congress of the Building and Construction Industry to bring together general contractors, sub-contractors, and workers in the building trade, architects, engineers, producers of and dealers in building equipment. It is proposed to make a scientific survey of the needs of the workers and the methods of training them and of the sources of supply of raw materials and manufactured products and to determine the national construction requirements for 1921 and future years.

At a conference held in Atlantic City, August 6, 1920, the representative architects, contractors, sub-contractors, engineers, labor men and manufacturers of building materials appointed an organizing committee which met in Chicago September 27 to create the National Congress of Building and Construction Interests, and appointed a Congress Executive Committee which met in Pittsburgh, October 29, and reorganized itself into an executive board composed of five general contractors, five sub-contractors, five architects, five engineers, five manufacturers and distributors of materials and equipment, and five representatives of labor and investment capital. The purpose of the executive board is not to create a national organization, but to form a deliberative body with mandatory power.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



ONE-MAN MOTOR CAR WITH HEATING AND ELECTRIC LIGHT SYSTEMS

FOUR-WHEEL DRIVE MOTOR CARS

Passenger motor cars operating on standard gauge railroad tracks have been perfected by the Four-Wheel Drive Auto Company, which recommends them for short-line runs, to save high operating cost that can be overcome by this vehicle, although they practically exclude ordinary steam or electric freight or passenger locomotive business. It is estimated that there are more than 600 short-line railroads in this country on which a considerable saving could be effected by the use of railroad motor cars instead of locomotives.

The New Orleans and Lower Coast Railway has installed a railway locomotive truck to replace a passenger train on a 60-mile run from Algiers to Duras, La. The regular motor and standard truck chassis, modified only by the substitution of steel flanged wheels, is used with a car body built in the railway company's workshops and providing seats for thirty-two persons. The entrance is from folding doors on the sides and the car, equipped with M. C. B. coupler, can be used for switching or hauling a trailer.

The starting and lighting system is furnished by a 24-volt single unit equipment and the exhaust gases from the motor are used to heat the car through radiator pipes on the sides.

As this motor truck car can be handled by one man and effects considerable economy in depreciation, fuel, breakage and replacement, its service saves approximately 25 per cent of the ordinary railroad service. The normal speed is 25 miles an hour, with 7½ to 9 miles per gallon of gasoline.

Another example of the application of the four-wheel drive principle to railroad transportation is afforded by a truck which has been successfully operated for nearly a year on a 16-mile run from Palatine to Lake Zurich, Ill.

A NEW ALL-MULTIPEDAL AUSTIN TRENCHING MACHINE

A new type of trenching machine now being placed on the market is designed to turn within its own length, and is absolutely a "one man" machine.

A screw hoist automatically raises and lowers the digging arm that carries an endless chain of standard type buckets. This screw hoist also acts to force the bucket line against the face of the ditch.

A cleaning device takes care of the sticky dirt and scrapes out each bucket as it passes a point at the head of the excavator boom directly over the conveyor belt, which can be adjusted to deliver the excavated material to either side of the machine.

The gasoline engine is of 4-cylinder, 4-cycle type, cooled by an enclosed radiator.

The digging width, with 18-inch buckets, will run from 20 inches to 28½ inches, and with 24-inch buckets from 26½ inches to 29 inches. The standard boom will dig up to 6 feet in depth, and the machine can be modified to dig 8 feet deep. Each of the two oscillating multipedal tractions is driven independently of the other by a friction clutch, so that in turning in a confined space, one may be stopped while the other is going ahead, turning the machine within its own length.

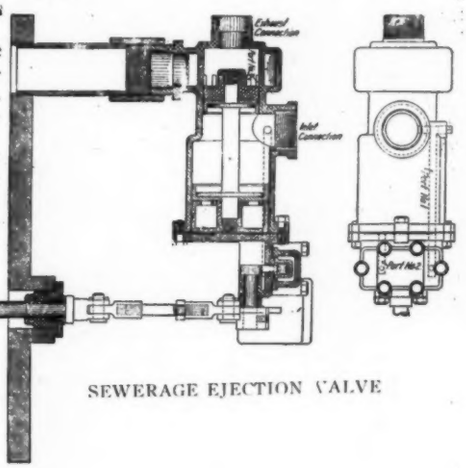
It is light enough to handle efficiently trenches for house connections, sewers, etc., and will cross sidewalks, climb over curbs, cross bridges, and travel over any and all types of pavements, thereby reducing to a minimum the danger of damage claims. Its road traction speed is higher than that of ordinary trenching machines.

An important feature is its easy interchangeability for digging trenches with vertical banks or small ditches with sloping sides.

COX OPERATING VALVE ILLUSTRATED

After a long series of tests the Pacific Flush-Tank Company offers the new Cox operating valve for sewage ejectors, for which it is recommended on account of the simplicity of construction, ease of maintenance, advantage of open float, and the small number of wearing parts, which consist of two standard cup leathers which can easily be purchased and replaced.

The admission of sewage to the ejector raises the float, which operates the lift-rod connected to the slide valve by a lever which turns it and uncovers the opening of port No. 2, thus allowing compressed air to pass from port No. 1 through port No. 2 to the back of the piston, equalizing the pressure and permitting the piston to travel toward the exhaust opening, where pressure admitted through port No. 3 forces out the sewage.



SEWERAGE EJECTION VALVE

After the sewage has been ejected, the bucket weight pulls down the operating lever and closes port No. 2, causing the piston to travel back to its original position closing port. No. 3 to pressure and opening them to exhaust, ready for another cycle.

UNION FITTS CHRONMETER VALVE

These valves manufactured by the Union Water Meter Company are recommended as standard where it is required to provide quickness and ease of operation and sensitive adjustment to varying conditions for the control and regulation of the flow of the steam, water, gas, oil and air to engines, stokers, tanks, blowers, etc.

They are easily adapted to service conditions and may be set vertical, horizontal or oblique without expensive special fitting. They are of the rotating type with a conical valve ground to a joint with ports completely opened or closed by a one-eighth turn.

HIGHWAY TRANSPORTATION NOTES

New York City's first Highway Transportation Show started on Monday, January 3, and continued right through until January 8, with something of interest every minute of the time. Because no one building large enough for all the exhibits could be secured in the city, the Motor Truck Association, under whose auspices the show was held, secured the Twelfth Regiment Armory and the First Field Artillery Armory. There is no distinction between the exhibits at the two armories, except that trucks exhibited at one armory were not duplicated in the other. The exhibit included twenty-six makes of motor trucks, three makes of trailers and a great array of parts and accessories.

Monday, January 3, was "Opening Day"; Tuesday, "Army Day"; Wednesday, "Motor Accident Prevention Day"; Thursday, "Transportation Day"; Friday, "Farmers' Day"; Saturday, "Motor Truck Association Day."

Special features of the show included a truck drivers' contest for a prize of $500, awarded to the driver best explaining in not more than 250 words the ten best points of any truck chassis exhibited in either of the two armories; and a special moving picture exhibition showing all means of both ancient and modern transportation by rail, waterway and highway, secured through the courtesy of Dr. Francis J. Halley of the U. S. Bureau of Economics. One of the most unusual films in this collection was that showing 90,000 camels snapped through a telescopic lens in the Algerian desert by the French government. All these films were run continuously.

The headliner among the motion picture films was an animated Bray cartoon reel on the Elements of the Motor Truck Engine.

On Army Day the most complete equipment ever gathered together for any other than military purposes, was exhibited, including several million candlepower dishpan searchlights which were stationed outside of each armory; a portable machine shop truck in operation; a rolling kitchen; an anti-aircraft gun; signal corps equipment and films of actual battle scenes; a wireless telephone and several makes of standardized army motor trucks. One special feature was a contest between two teams of army motor mechanics in disassembling and reassembling a Class B standardized truck engine against time for a cash prize.

Dr. John A. Harriss, Deputy Police Commissioner in charge of traffic, New York City, and inventor of the modified block system of traffic control on Fifth avenue, gave a talk on preventing motor vehicle accidents.

Other speakers were Ex-Governor Smith, who had just joined the U. S. Trucking Corporation; E. S. Farr, chief of the Firestone Ship-by-Truck Bureaus, who gave a talk and exhibited his unusual film entitled "The Neck of the Bottle,"; and James W. Brooks, director of the Federal Highway Council, who spoke on the necessity for adequate truck highways and exhibited his film, "Trucking through Dixie."

INDUSTRIAL NOTES

ERRATUM

In the review of the High Efficiency Pumping Machinery Catalog of the Blake Pump and Condensor Co. that was published on page 19, January 1, substitute electric for "steam," in the fourth line of the article. The efficient application of a motor drive instead of steam is an important feature of the improved equipment.

DECEMBER LUMBER PRODUCTION FAR BELOW NORMAL

The Southern Pine Association reports that for the week ending December 31 out of 89 sawmills 58 were shut down and only 4 operated on full time, the remainder being run from one to five days each during the week and together with 36 other mills, which did not specify the amount of time run producing a total of only 689,206 feet during the week, and amount which is 73.86 per cent below normal.

AUSTIN MACHINERY CORP. ACQUIRES FAIRMONT PLANT

The large plant of the Fairmont Machine Company, of Fairmont, W. Va., has become the property of the Austin Machinery Corporation, of Chicago and New York, manufacturers of earth-working, concrete-mixing and material-handling machinery, and will continue to make its own line of machinery besides contributing to the manufacture and distribution of earth-handling and cement-mixing machinery.

AMERICAN ROAD BUILDING ASSOCIATION

At the exhibition of road materials and equipment to be held at the Coliseum, Chicago, February 9, 10, 11 and 12, more than one-half million dollars' worth of machinery will be on display, the Austin Machinery Corporation alone supplying more than seventy-two tons. Excellent entertainment will be provided. The city of Chicago has appropriated $15,000 for this purpose. Cuba and Hawaii will be represented by special delegations.

WHAT IS YOUR HIGHWAY PROBLEM?

A free portfolio entitled, "What Is Your Highway Problem?" has just been issued by the asphalt sales department of the Texas Company. It describes the steps in the construction of the various types of asphaltic pavements and roads. Each type of construction is illustrated with photographs and some are supplemented by drawings.

The types of asphaltic construction discussed are sheet asphalt, asphaltic concrete, asphalt macadam, asphalt for surface treatment, asphaltic road oils, asphalt filler, asphalt foundation, the use of asphalt to resurface worn brick and to resurface cement concrete. The portfolio begins with a description of Texaco highway service and ends with a list of Texaco products and their various uses.

The Philadelphia Electric Co., Philadelphia, Pa., will build a new conveyor system for coal and ash handling at its plant at Beach and Palmer streets. The contract for this work, which will cost approximately $75,000, has been let to Stone & Webster, New York.

PERSONALS

Popham, Owen, formerly city councilman, has been appointed chief engineer of the water works of Coshocton, Ohio.

Barber, William C., mayor of Joliet, Ill., has accepted the position of city manager of Dayton, Ohio.

Clark, Edward S., who has been in the employ of the city of Kalamazoo, Mich., for more than thirteen years, has been appointed city engineer.

Hendry, W. A., has been appointed chief water works engineer of Waterloo, Iowa.

Storm, John, has been appointed engineer of the water works plant of the Public Service Co. at Mattoon, Ill.

Hiet, Melvin E., is now engineer of Nowata county, Okla., and is also engineer for Pawnee county.

Huber, J. E., district engineer of the Illinois Department of Public Works and Buildings, Division of Highways, has resigned to accept a position with the Western Wheeled Scraper Co., Aurora, Ill.

Cadle, Charles L., chief engineer of the Rochester Lines of the New York State Rys., has been appointed by Governor Miller as superintendent of Public Works.

Golden, Louis V., Barnes, Loewis E., and Whitwham, William, members of the board of water commissioners of Methuen, Mass., have tendered their resignations to Mayor Rushton, charging lack of co-operation on the part of the city council.

Bamford, William R., M. Am. Soc. C. E., was recently elected mayor of Belmar, N. J. He is planning the adoption of the borough manager type of government, which will be the first of its kind in New Jersey.

Cloney, Thomas, has been appointed city manager of Vicksburg, Mich.

Brett, J. L., who since 1919 has been assistant engineer of the water works of Montreal, has been appointed design engineer of the Montreal water board.

Shields, Francis S., has resigned as secretary of the sewer and water board of New Orleans, and will be succeeded by A. G. Moffatt, who has been assistant secretary since 1903.

Davis, S. B., has resigned as county engineer of Wood county, Texas.

Arnold, E. M., has resigned as county engineer of Boone county, Ky., and is now assistant engineer with the Georgia State Highway Department.

Peabody, L. H., civil engineer in the bridge department of the Rhode Island State Department of Public Roads, died on November 16, at the age of 42 years.

Wood, W. T. S., president of the board of county commissioners of Gibson county, Indiana, died on November 20.

Kyle, H. L. I., formerly roadmaster at Sacramento, has been appointed engineer of the Western Division, Western Pacific.

Moore, Thomas J., city manager of Guelph, Ont., since 1908, was killed recently in Northern Ontario while on a shooting trip.